

REMARKS

Claims 1-3, 5-21, 24-30, 32-54, 56-64, and 66-71 are pending. Claims 1, 30, 53, and 63 are independent claims. With this amendment, claim 1 is amended.

The indication of the allowable subject matter in claims 63, 64, and 66-71 in the Office Action is appreciated.

Rejection of independent claim 1

Independent claim 1 was rejected under 102(b) as being anticipated by Buskirk (2002/0011463). This rejection is traversed. However, claim 1 is amended herein to place claim 1 into a better form for examination.

As background, Buskirk is directed to a cleaning process. In the specification, Buskirk discusses a batch contacting method (paragraph [0035]) and a continuous gas flow method (paragraph [0036]). In the batch contacting method, a chamber containing the microelectronic device structure is evacuated and backfilled with the reactive halide gas or a mixture of the reactive halide gas and other gas(es), either inert or reactive. After the reactive halide is allowed to react for a predetermined amount of time, the chamber is evacuated and backfilled again with fresh cleaning gas. The exposure time can be from about 10 seconds to about 10 min, and the number of exposure cycles is not limited, but will depend on the amount of material to be removed. In the continuous gas flow method, a steady state flow of the reactive halide gas is introduced to the chamber containing the microelectronic device structure to be cleaned.

In contrast, the invention set forth in claim 1 is directed to an etching method that is not continuous or batch as described in Buskirk. Specifically, the etching method set forth in claim 1 explicitly recites, among other features, a step of providing a spontaneous vapor phase etchant recipe to the etch system so as to etch the sacrificial material; and measuring an amount of a chemical species in the process; determining a feeding time based on the measurement; and further etching the sacrificial material by providing an additional amount of the spontaneous vapor phase etchant recipe to the etch system based on the determined feeding time to continue the process. It is respectfully submitted that the above feature is nowhere disclosed or suggested by Buskirk.

In the Office Action, the Examiner contended that paragraph [0036] of Buskirk teaches the above step of measuring the amount of the chemical recipe in the process. The undersigned respectfully disagrees. In fact, the undersigned can not find a step of measuring the amount of a chemical recipe in paragraph [0036] or any other paragraphs of Buskirk.

In the Office Action, the Examiner further contended that paragraph [0039] of Buskirk teaches the above step of determining a feeding time based on the measurement. Paragraph [0039] recites that

“The time and contacting conditions for the reactive halide etch process may be readily determined by those of ordinary skill in the art. The nature and extent of the etching of the deposited noble metal-based material may be empirically determined while varying the time and/or contacting conditions (such as temperature, pressure, concentration and partial pressure) of the etching agent to identify the process conditions producing a desired etching result.” To paraphrase paragraph 0039, “You can play around with your etching conditions to figure out how to achieve the etch result you desire”. Paragraph [0039] does not teach or suggest, however, measuring an amount of a chemical species in a spontaneous etching process; determining a feeding time based on the measurement; and further etching the sacrificial material by providing an additional amount of the spontaneous vapor phase etchant recipe to the etch system based on the determined feeding time to continue the process. This detailed sequence of steps as set forth in claim 1 is not anticipated or obvious from a general statement that the cleaning process can be optimized to achieve the desired result.

The Examiner’s attention is also directed to the dependent claims which are not taught or suggested by Buskirk. As but two examples are claim 3 (wherein the chemical species is an etch product), and claim 6 (wherein the noble gas halide is xenon difluoride). These features are nowhere taught or suggested in the Buskirk reference. However the dependent claims should all be allowable as being dependent upon an allowable independent claim.

In view of the above and other reasons, it is respectfully submitted that Buskirk does not teach or suggest all features in claim 1, or any of the claims depending therefrom. Reconsideration and withdrawal of the rejection are respectfully suggested.

Rejection of independent claim 30

Independent claim 30 was rejected under 102(b) as being anticipated by Buskirk. This rejection is traversed because it is respectfully submitted that Buskirk does not teach or suggest all features of claim 30.

For example, the etching process as set forth in claim 30 expressly recites, among other steps, that at a first time the etchant recipe is provided at a first amount per unit time, and wherein at a second time the etchant recipe is provided at a second amount per unit time that is a different from the first amount per unit time. Even though Buskirk discussed in paragraph [0036] that *“The second technique using the reactive halide gas as an isotropic etch agent is a continuous gas flow method.... and total flow rate of the reactive halide gas can be from about 1 standard cubic centimeter per minute (scem) to about 10 standard liters per minute (slm), the 1 scem to 10 slm are exemplary flow rates for different continuous etching processes.* In other words, one continuous etching process uses single flow rate with a value from

1 seem to 10 slm. Buskirk does not teach or suggest varying etchant feeding rates in single etching process, as set forth in claim 30.

It is respectfully submitted that Buskirk does not teach or suggest all features in claim 30. Reconsideration and withdrawal of the rejection are respectfully suggested.

Rejection of independent claim 53

With respect to the Examiner's rejection of claim 53 under 102(b) over Buskirk, this rejection is traversed.

Claim 53 expressly recites, among other features, the step of providing an etchant recipe that is a spontaneous vapor phase etchant to the etch chamber over time, wherein an amount of the etchant is varied when a change of a measured parameter is beyond a predetermined value during the etching, and wherein the amount of the etchant is varied from a first amount to a second amount and wherein both the first and second amounts are not 0. This feature is nowhere disclosed or suggested by Buskirk.

Buskirk discussed in paragraph [0036] that "*The second technique using the reactive halide gas as an isotropic etch agent is a continuous gas flow method.... and total flow rate of the reactive halide gas can be from about 1 standard cubic centimeter per minute (sccm) to about 10 standard liters per minute (slm)*, the 1 sccm to 10 slm are exemplary flow rates for different continuous etching processes. In other words, one continuous etching process uses single flow rate with a value from 1 sccm to 10 slm. Buskirk does not teach or suggest varying the amount of etchant in single etching process, as set forth in claim 30.

It is respectfully submitted that Buskirk does not teach or suggest all features in claim 30. Reconsideration and withdrawal of the rejection are respectfully suggested.

It is believed that this application is in condition for allowance. Favorable consideration and prompt allowance are respectfully requested. In the event any fees are required in connection with this paper, please charge our Deposit Account No. 20-0668.

Respectfully submitted,



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